Soil Bulk Density
Field and Lab Guide

Task

To obtain three bulk density measurements for each of the horizons in a soil profile

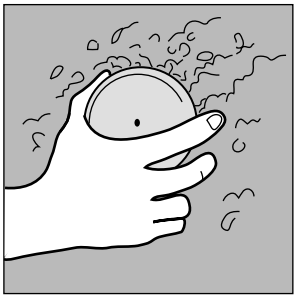
What You Need

- ❑ Balance
- ❑ Sampling cans or other containers (enough for three per horizon plus a few extra, in case some of the cans become bent)
- ❑ Permanent marker
- ❑ Wood block
- ❑ Hammer
- ❑ Nail
- ❑ Pencil or pen
- ❑ Sealable plastic bags, jars, or other containers to store samples and extra soil
- ❑ Drying oven
- ❑ Graduated cylinder
- ❑ Water
- ❑ #10 Sieve (2 mm mesh openings)
- ❑ Rubber gloves
- ❑ Paper to catch sieved soil
- ❑ Rolling pin, hammer, or other utensil for crushing peds and separating particles
- ❑ Trowel, shovel, or other digging device
- ❑ *Bulk Density Data Sheet*

In the Classroom Before Sampling

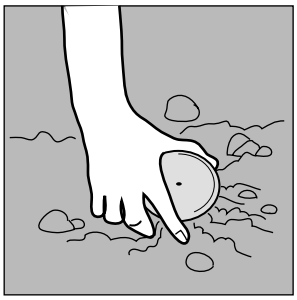
1. Collect required equipment.
2. Calibrate the balance to 0.1 g.
3. Measure the mass and volume of each can without the lid on and record these measurements onto the *Bulk Density Data Sheet*.
4. Label each can with a number.
5. Punch a small hole into the bottom of each can using the nail and hammer.

In the Field



1. For each horizon in your soil profile, push a can into the side of the horizon. If necessary, wet the soil first in order to ease the can into the soil. Stop when soil pokes through the small hole in the bottom of the can.

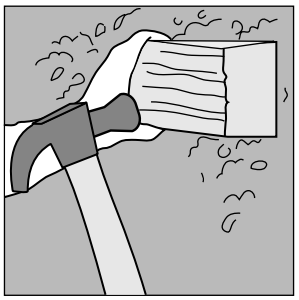
   If it is difficult to push the can into the soil, place a piece of wood over the can and hit the wood with a hammer. This spreads the force of the hammer blow to all edges of the can at once and minimizes bending the can sides. If the sides of the can become bent, this will change the volume of the can and may compact the soil sample, affecting the measurement results. If the sides of the can bend beyond perpendicular, discard it and use another can.



   Note: If you do not have a pit or other exposed soil profile you can measure the bulk density of the soil surface as follows.

   a. Choose three locations close to where your *Soil Characterization Protocol* was measured. Remove vegetation and other material from the soil surface.

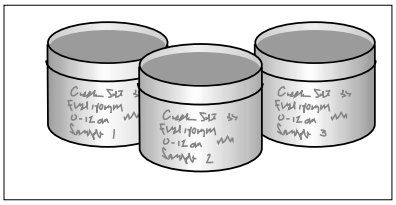
   b. At each location, push a can with a known volume into the surface of the soil. If necessary, wet the soil first in order to ease the can into the soil. Stop when soil pokes through the small hole in the bottom of the can.



2. Using a trowel or shovel, dig around the can to remove it and the surrounding soil. Trim the soil from the top and around the edges of the can so that the volume of the soil is the same as the volume of the can.

3. Cover the labeled can with its lid or other cover.

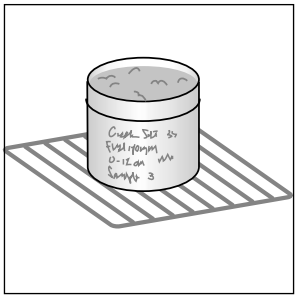
4. Repeat this procedure so that you have three bulk density samples for each horizon in your profile.



In the Classroom After Sampling

1. Remove the lid of the can. Weigh each sample in its can, and record this as the wet mass on the *Bulk Density Data Sheet.*

2. Dry the samples in a soil-drying oven. See the *Gravimetric Soil Moisture Protocol* for instructions on drying soils.

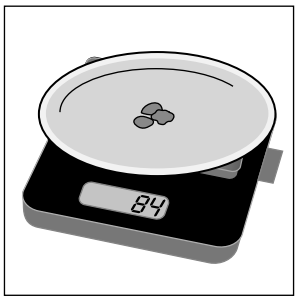


3. After the soils have dried, weigh each sample in its container and record this as the dry mass on the *Bulk Density Data Sheet.*

4. Hold a sieve (#10, 2 mm mesh) over a paper plate or large piece of paper (such as newspaper) and pour one sample onto the sieve. Put on rubber gloves to avoid contaminating your sample with acids from your skin.

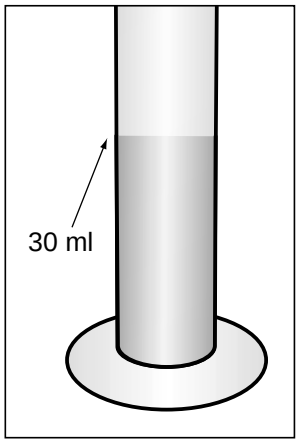
5. Carefully push the dried soil material through the mesh onto the paper plate. Be careful not to bend the wire mesh by forcing the soil through. Rocks will stay on top of the sieve. If no sieve is available, carefully remove the rocks by hand. Save the sieved soil from each sample for the other lab analyses.

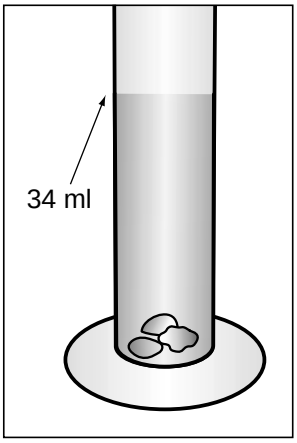
6. If rocks are present, use the following procedure to determine the mass and volume of the rocks.
   a. Weigh the rocks and record this mass on the *Bulk Density Data Sheet.*
   b. Place 30 mL of water in a 100 mL graduated cylinder. Record this volume of water on the *Bulk Density Data Sheet*. Gently place the rocks in the water. Read the level of the water after all the rocks have been added. Record this volume of water on the *Bulk Density Data Sheet.*



Note: As you add the rocks, if the volume of the water comes close to 100 mL, record the increase in volume, empty the cylinder and repeat the procedure for the remaining rocks. In this case, you must record the sum of the water volumes with the rocks and the sum of the water volumes without the rocks.

If you have sticks or other organic debris, substitute alcohol for water, and follow the same procedure.





7. Transfer the rock-free dry soil from the paper under the sieve to clean dry plastic bags or containers. Seal the containers, and label them with horizon number, top and bottom depth, date, site name, and site location. This soil can now be used for the other lab analyses. Store these samples in a safe, dry place until they are used.